

FIG. 1

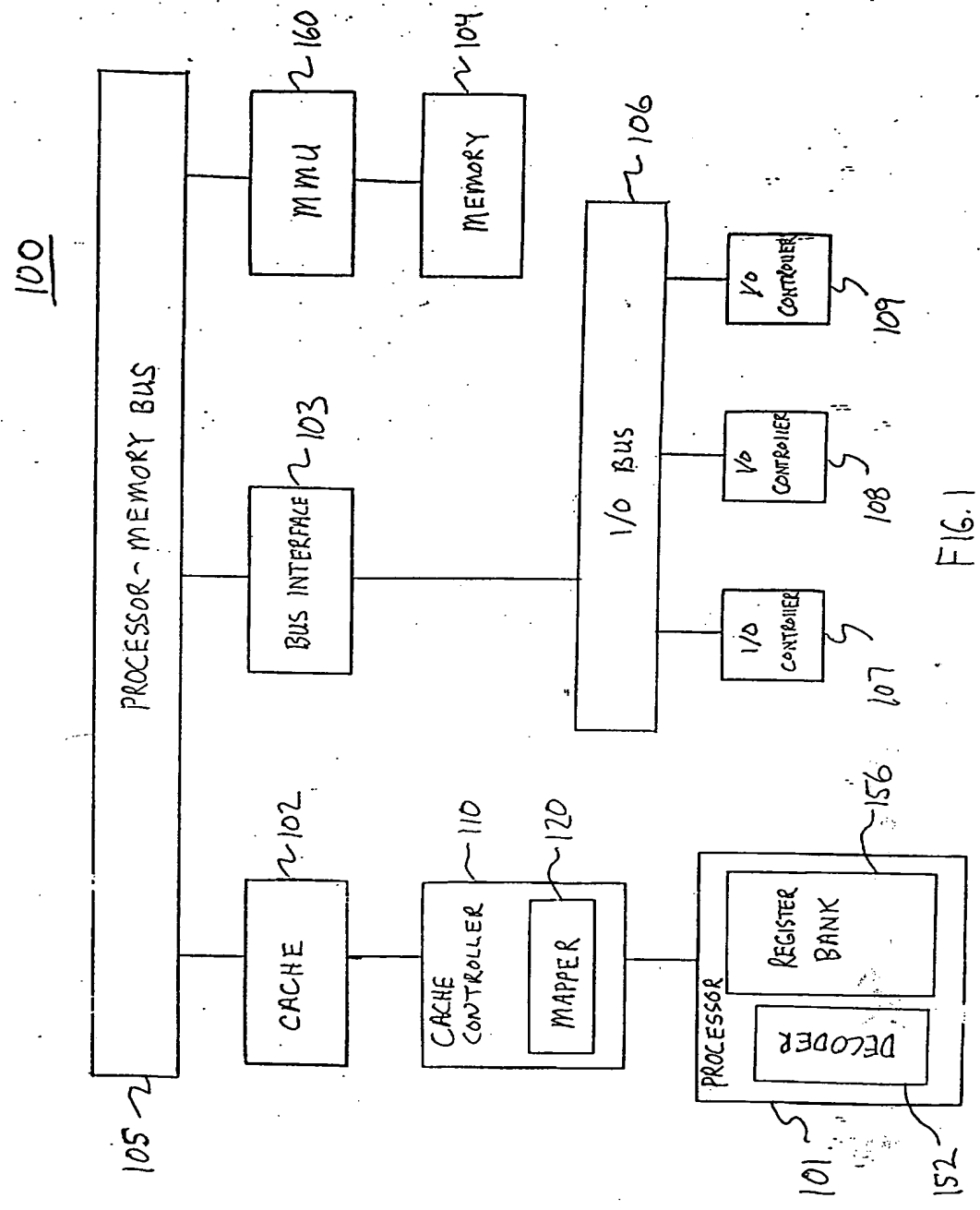


FIG. 1

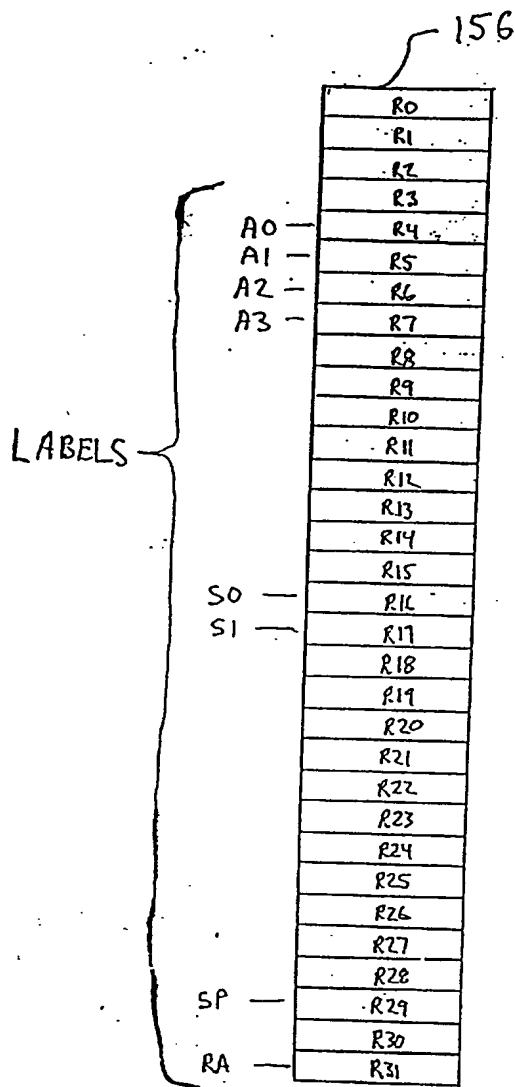


FIG. 2

104

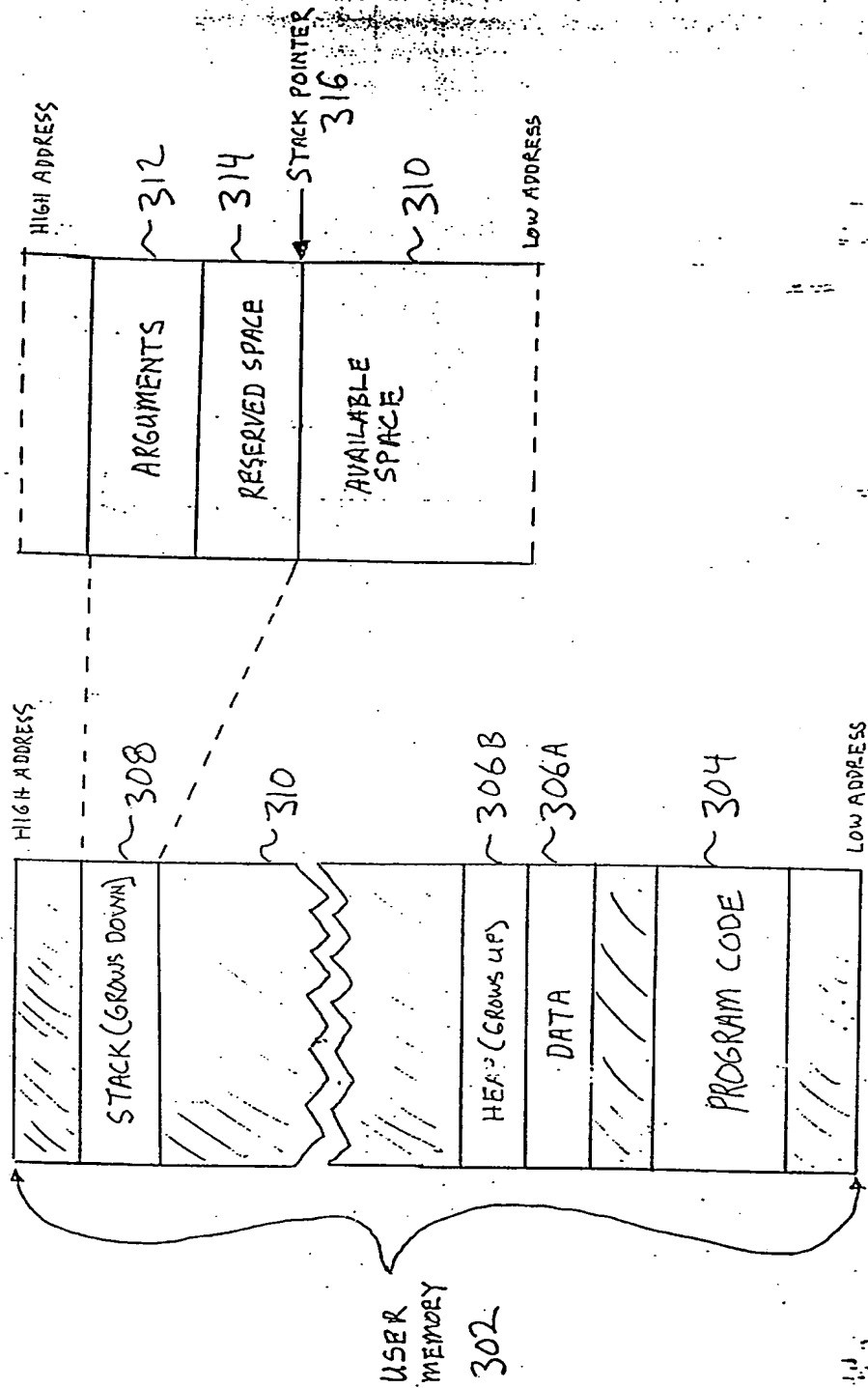


FIG. 3

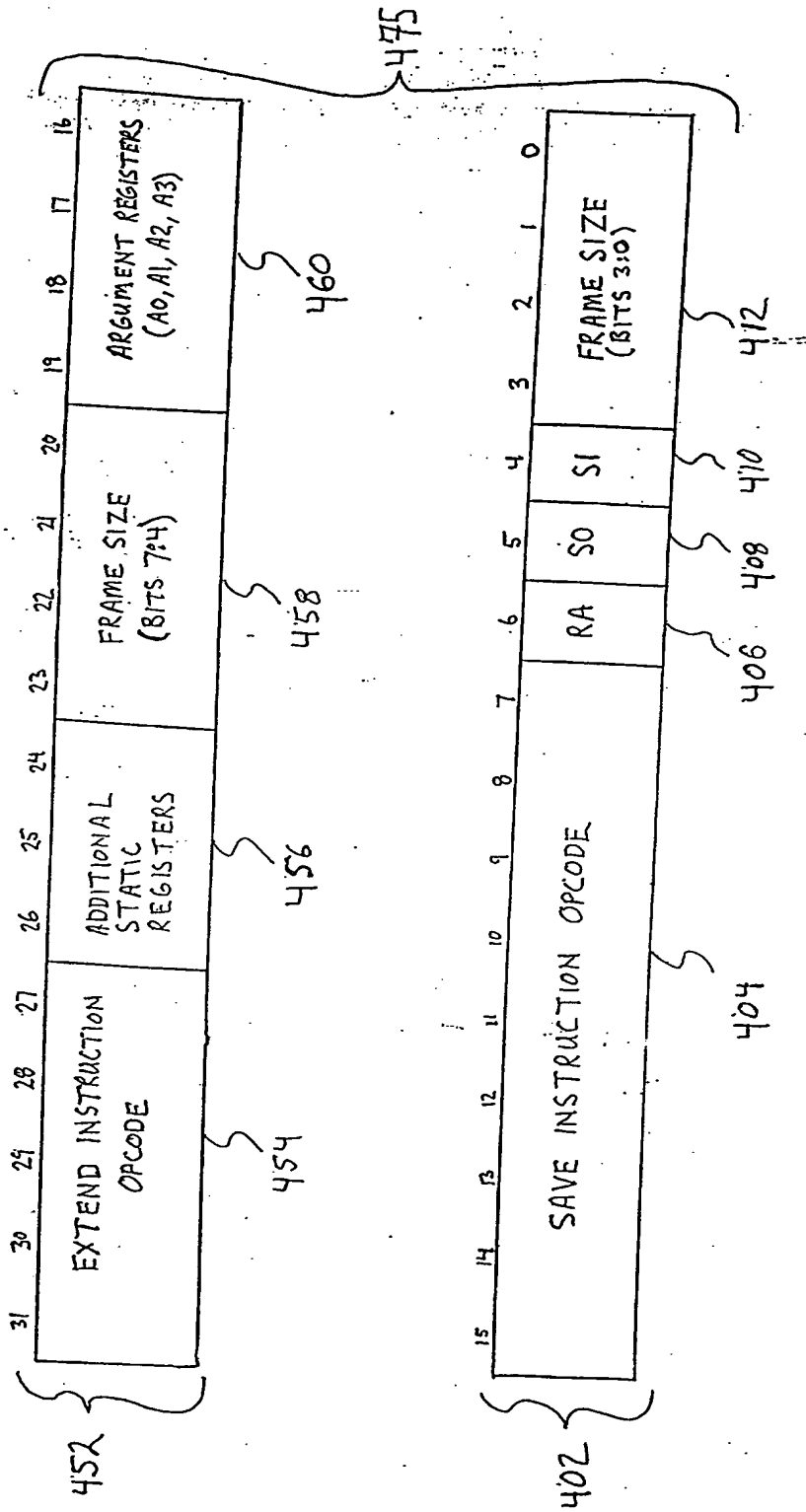


FIG. 4

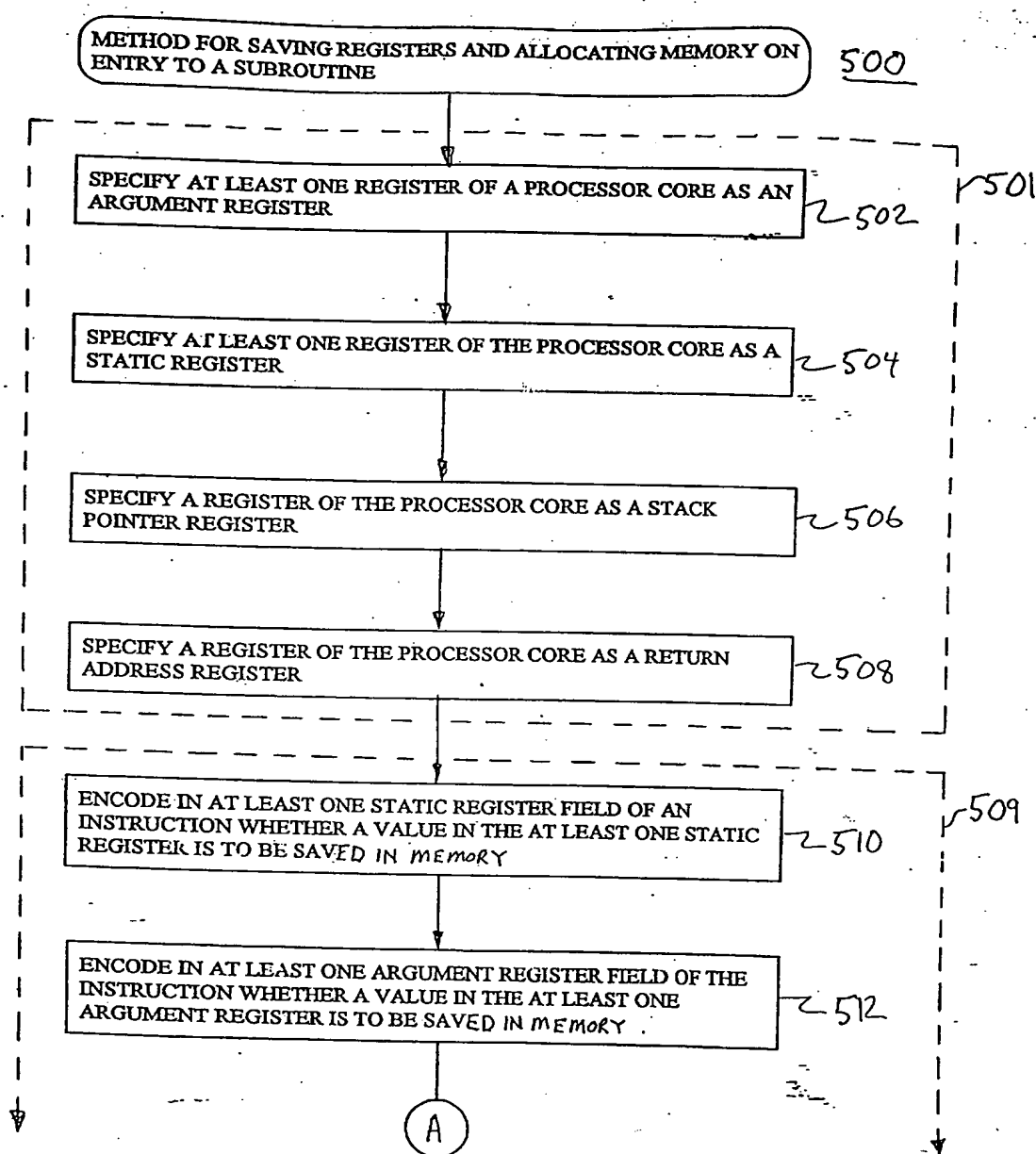


FIG. 5A

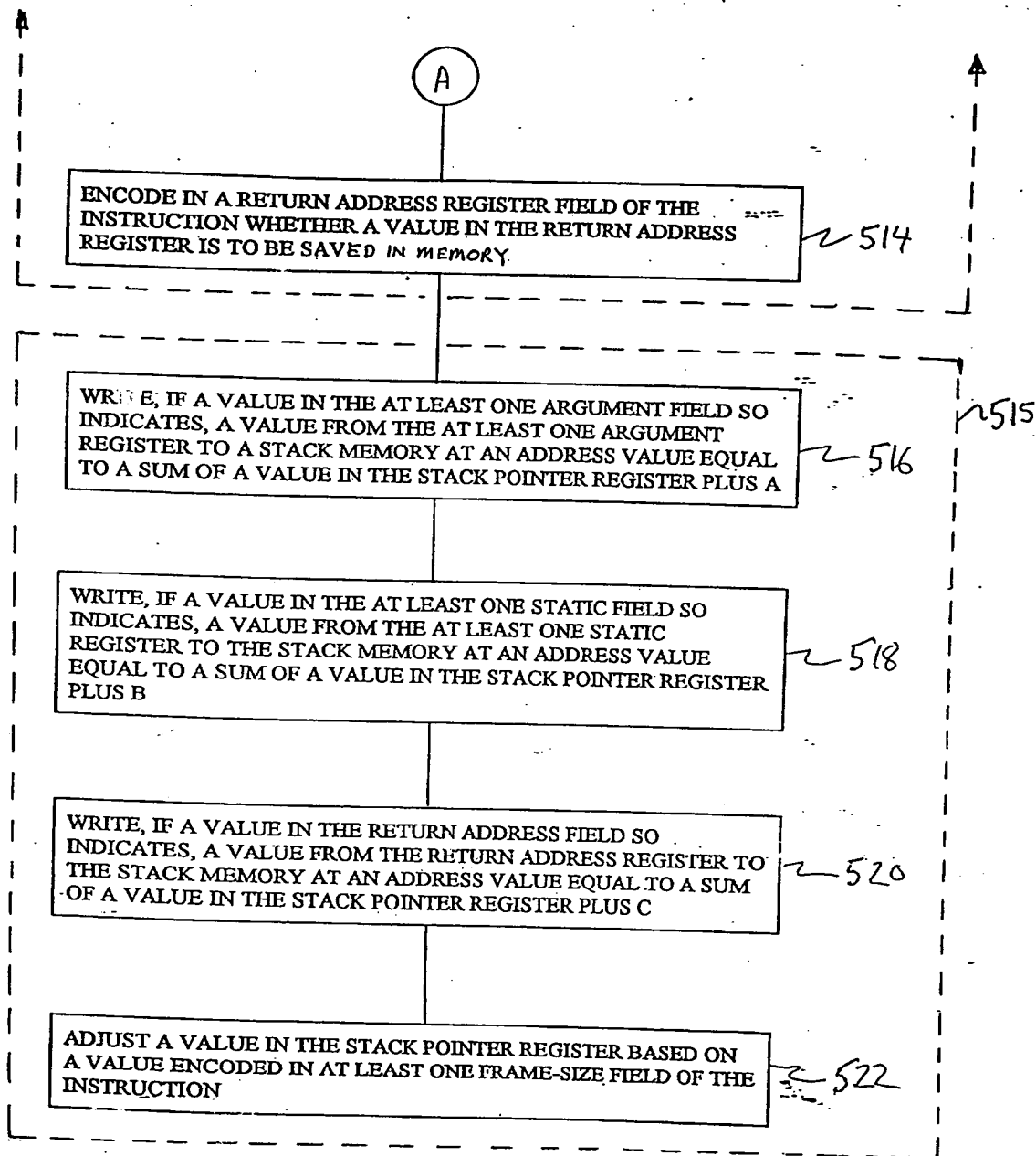


FIG. 5B

SAVE INSTRUCTION

```
temp ← GPR[29]
if ra = 1 then
    temp ← temp - 4
    VirtualMemory[temp] ← GPR[31]
endif
if sl = 1 then
    temp ← temp - 4
    VirtualMemory[temp] ← GPR[17]
endif
if s0 = 1 then
    temp ← temp - 4
    VirtualMemory[temp] ← GPR[16]
endif
if framesize = 0 then
    temp ← GPR[29] - 128
else
    temp ← GPR[29] - (0 || (framesize << 3))
endif
GPR[29] ← temp
```

FIG. 6

<i>aregs</i> Encoding (binary)	Registers Saved as Arguments	Registers Restored as StaticRegisters
0000	None	None
0001	None	GPR[7]
0010	None	GPR[6], GPR[7]
0011	None	GPR[5], GPR[6], GPR[7]
1011	None	GPR[4], GPR[5], GPR[6], GPR[7]
0100	a0	None
0101	a0	GPR[7]
0110	a0	GPR[6], GPR[7]
0111	a0	GPR[5], GPR[6], GPR[7]
1000	a0, a1	None
1001	a0, a1	GPR[7]
1010	a0, a1	GPR[6], GPR[7]
1100	a0, a1, a2	None
1101	a0, a1, a2	GPR[7]
1110	a0, a1, a2, a3	None
1111	Reserved	Reserved

FIG. 7

EXTENDED SAVE INSTRUCTION

```

temp ← GPR[29]
temp2 ← GPR[29]
case args of
    2#0000 2#0001 2#0010 2#0011 2#1011: args ← 0
    2#0100 2#0101 2#0110 2#0111: args ← 1
    2#1000 2#1001 2#1010: args ← 2
    2#1100 2#1101: args ← 3
    2#1110: args ← 4
    otherwise: UNPREDICTABLE
endcase
if args > 0 then
    VirtualMemory[temp] ← GPR[4]
    if args > 1 then
        VirtualMemory[temp + 4] ← GPR[5]
        if args > 2 then
            VirtualMemory[temp + 8] ← GPR[6]
            if args > 3 then
                VirtualMemory[temp + 12] ← GPR[7]
            endif
        endif
    endif
endif
if ra = 1 then
    temp ← temp - 4
    VirtualMemory[temp] ← GPR[31]
endif
if xsregs > 0 then
    if xsregs > 1 then
        if xsregs > 2 then
            if xsregs > 3 then
                if xsregs > 4 then
                    if xsregs > 5 then
                        if xsregs > 6 then
                            temp ← temp - 4
                            VirtualMemory[temp] ← GPR[30]
                        endif
                    endif
                endif
            endif
        endif
    endif
    temp ← temp - 4
    VirtualMemory[temp] ← GPR[23]
endif
    temp ← temp - 4
    VirtualMemory[temp] ← GPR[22]
endif
temp ← temp - 4
VirtualMemory[temp] ← GPR[21]
endif

```

FIG. 8A

EXTENDED SAVE INSTRUCTION

```

temp ← temp - 4
    VirtualMemory[temp] ← GPR[20]
    endif
    temp ← temp - 4
    VirtualMemory[temp] ← GPR[19]
    endif
    temp ← temp - 4
    VirtualMemory[temp] ← GPR[18]
    endif
    if sl = 1 then
        temp ← temp - 4
        VirtualMemory[temp] ← GPR[17]
    endif
    if s0 = 1 then
        temp ← temp - 4
        VirtualMemory[temp] ← GPR[16]
    endif
    case aregs of
        2#0000 2#0100 2#1000 2#1100 2#1110: astatic ← 0
        2#0001 2#0101 2#1001 2#1101: astatic ← 1
        2#0010 2#0110 2#1010: astatic ← 2
        2#0011 2#0111: astatic ← 3
        2#1011: astatic ← 4
        otherwise: UNPREDICTABLE
    endcase
    if astatic > 0 then
        temp ← temp - 4
        VirtualMemory[temp] ← GPR[7]
        if astatic > 1 then
            temp ← temp - 4
            VirtualMemory[temp] ← GPR[6]
            if astatic > 2 then
                temp ← temp - 4
                VirtualMemory[temp] ← GPR[5]
                if astatic > 3 then
                    temp ← temp - 4
                    VirtualMemory[temp] ← GPR[4]
                endif
            endif
        endif
    endif
    temp ← temp2 - (0 || (framesize << 3))
    GPR[29] ← temp

```

FIG. 8B

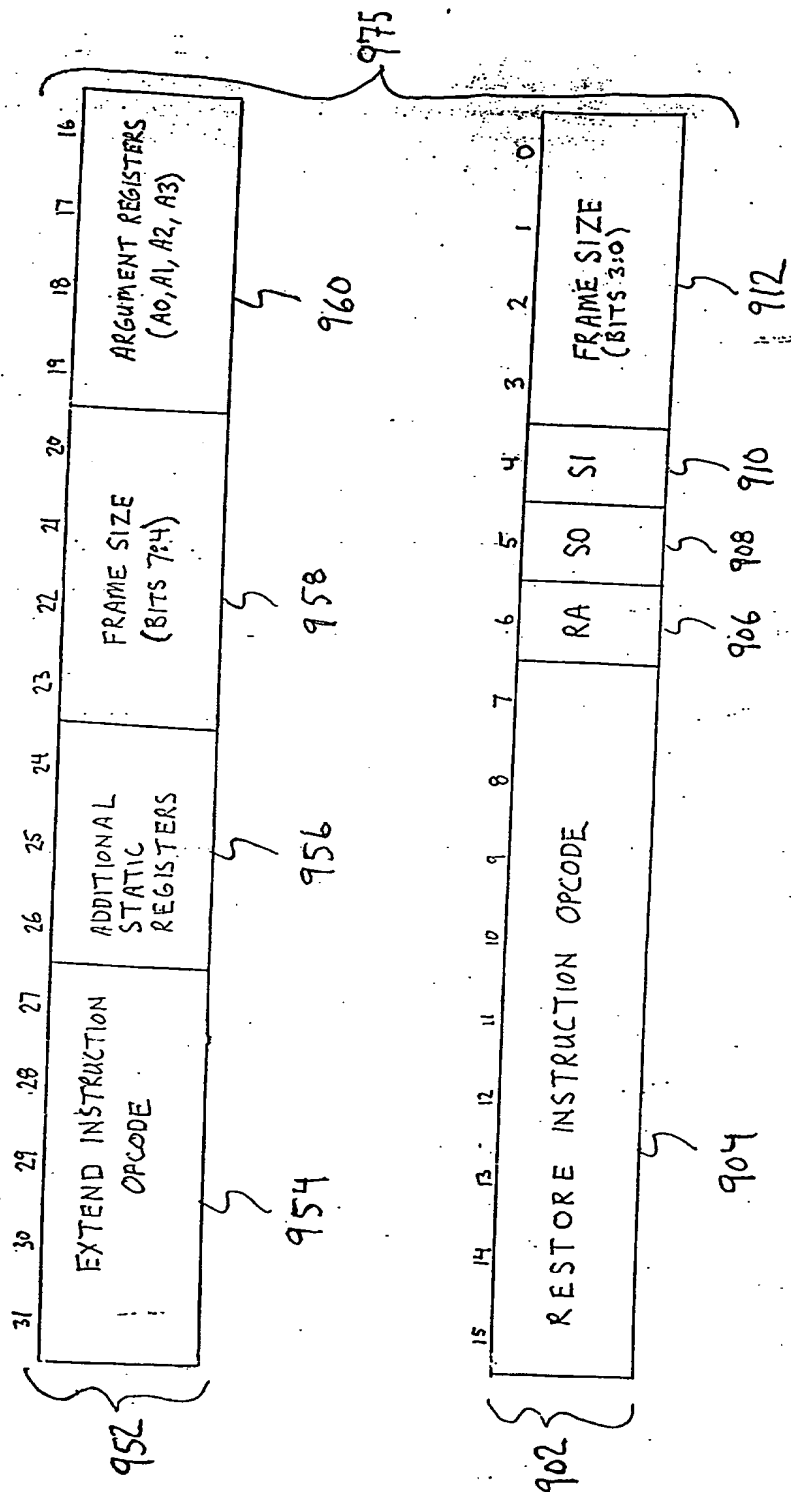


FIG. 9

METHOD FOR RESTORING REGISTERS AND DEALLOCATING
MEMORY BEFORE EXIT FROM A SUBROUTINE

1000

SPECIFY AT LEAST ONE REGISTER OF A PROCESSOR CORE AS AN
ARGUMENT REGISTER

1001

1002

SPECIFY AT LEAST ONE REGISTER OF THE PROCESSOR CORE AS A
STATIC REGISTER

1004

SPECIFY A REGISTER OF THE PROCESSOR CORE AS A STACK
POINTER REGISTER

1006

SPECIFY A REGISTER OF THE PROCESSOR CORE AS A RETURN
ADDRESS REGISTER

1008

ENCODE IN AT LEAST ONE STATIC REGISTER FIELD OF AN
INSTRUCTION WHETHER A VALUE IN MEMORY IS TO BE ~~SAVED TO~~
THE AT LEAST ONE STATIC REGISTER

1009

1010

A

FIG. 10A

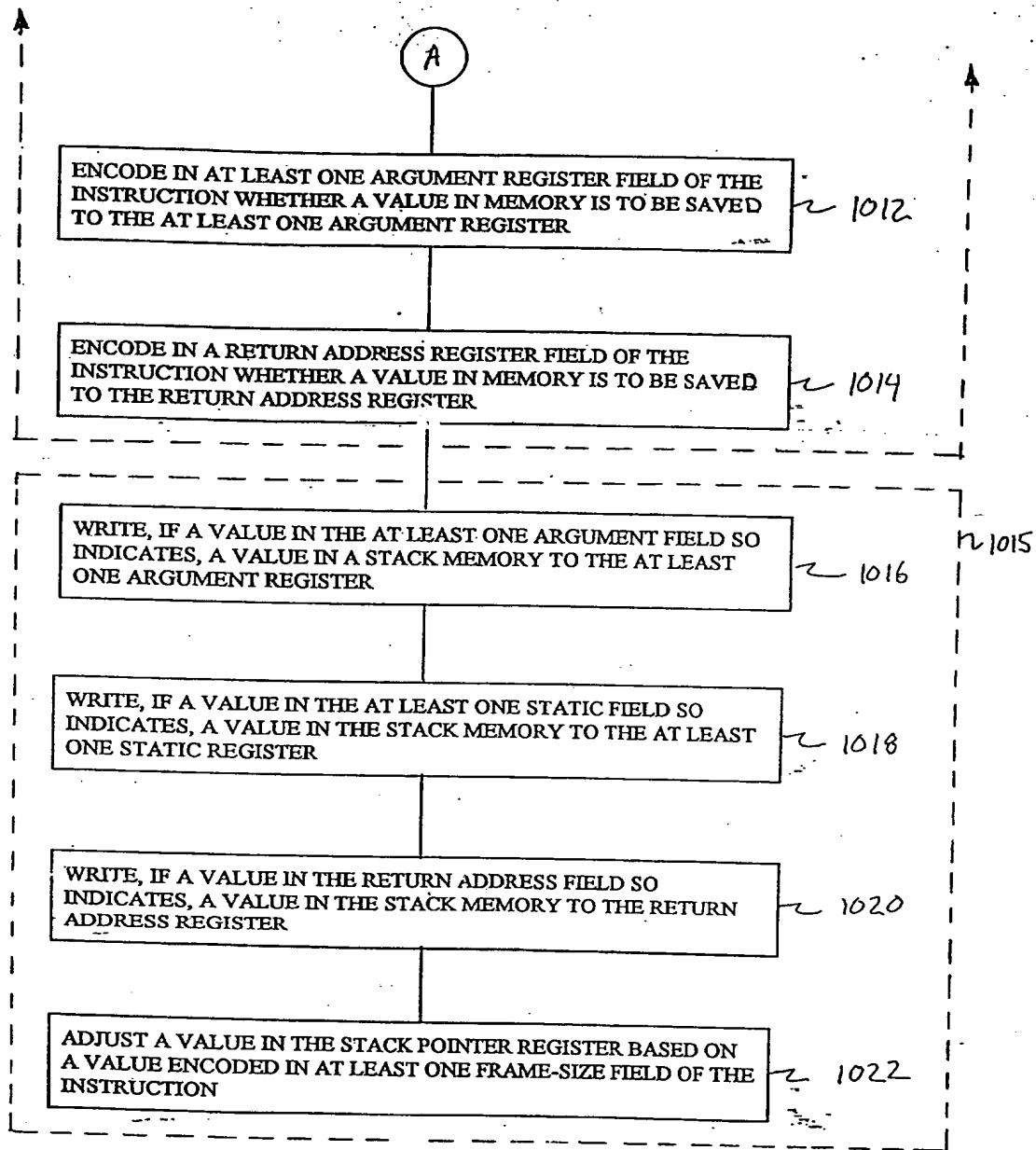


FIG. 10B

1100

RESTORE INSTRUCTION

```
if framesize = 0 then
    temp ← GPR[29] + 128
else
    temp ← GPR[29] + (0 || (framesize << 3))
endif
temp2 ← temp
if ra = 1 then
    temp ← temp - 4
    GPR [31] ← VirtualMemory [temp]
endif
if sl = 1 then
    temp ← temp - 4
    GPR [17] ← VirtualMemory [temp]
endif
if s0 = 1 then
    temp ← temp - 4
    GPR [16] ← VirtualMemory [temp]
endif
GPR[29] ← temp2
```

FIG. 11

1200

EXTENDED RESTORE INSTRUCTION

```
temp ← GPR[29] + (0 || (framesize << 3))
temp2 ← temp
if ra = 1 then
    temp ← temp - 4
    GPR[31] ← VirtualMemory[temp]
endif
if xsregs > 0 then
    if xsregs > 1 then
        if xsregs > 2 then
            if xsregs > 3 then
                if xsregs > 4 then
                    if xsregs > 5 then
                        if xsregs > 6 then
                            temp ← temp - 4
                            GPR[30] ← VirtualMemory[temp]
                        endif
                        temp ← temp - 4
                        GPR[23] ← VirtualMemory[temp]
                    endif
                    temp ← temp - 4
                    GPR[22] ← VirtualMemory[temp]
                endif
                temp ← temp - 4
                GPR[21] ← VirtualMemory[temp]
            endif
            temp ← temp - 4
            GPR[20] ← VirtualMemory[temp]
        endif
        temp ← temp - 4
        GPR[19] ← VirtualMemory[temp]
    endif
    temp ← temp - 4
    GPR[18] ← VirtualMemory[temp]
endif
```

FIG. 12A

EXTENDED RESTORE INSTRUCTION

```

if s1 = 1 then
    temp ← temp - 4
    GPR[17] ← VirtualMemory [temp]
endif
if s0 = 1 then
    temp ← temp - 4
    GPR[16] ← VirtualMemory [temp]
endif
case aregs of
    2#0000 2#0100 2#1000 2#1100 2#1110: astatic ← 0
    2#0001 2#0101 2#1001 2#1101: astatic ← 1
    2#0010 2#0110 2#1010: astatic ← 2
    2#0011 2#0111: astatic ← 3
    2#1011: astatic ← 4
    otherwise: UNPREDICTABLE
endcase
if astatic > 0 then
    temp ← temp - 4
    GPR[7] ← VirtualMemory [temp]
    if astatic > 1 then
        temp ← temp - 4
        GPR[6] ← VirtualMemory [temp]
        if astatic > 2 then
            temp ← temp - 4
            GPR[5] ← VirtualMemory [temp]
            if astatic > 3 then
                temp ← temp - 4
                GPR[4] ← VirtualMemory [temp]
            endif
        endif
    endif
endif
endif
GPR[29] ← temp2
    
```

FIG. 12B

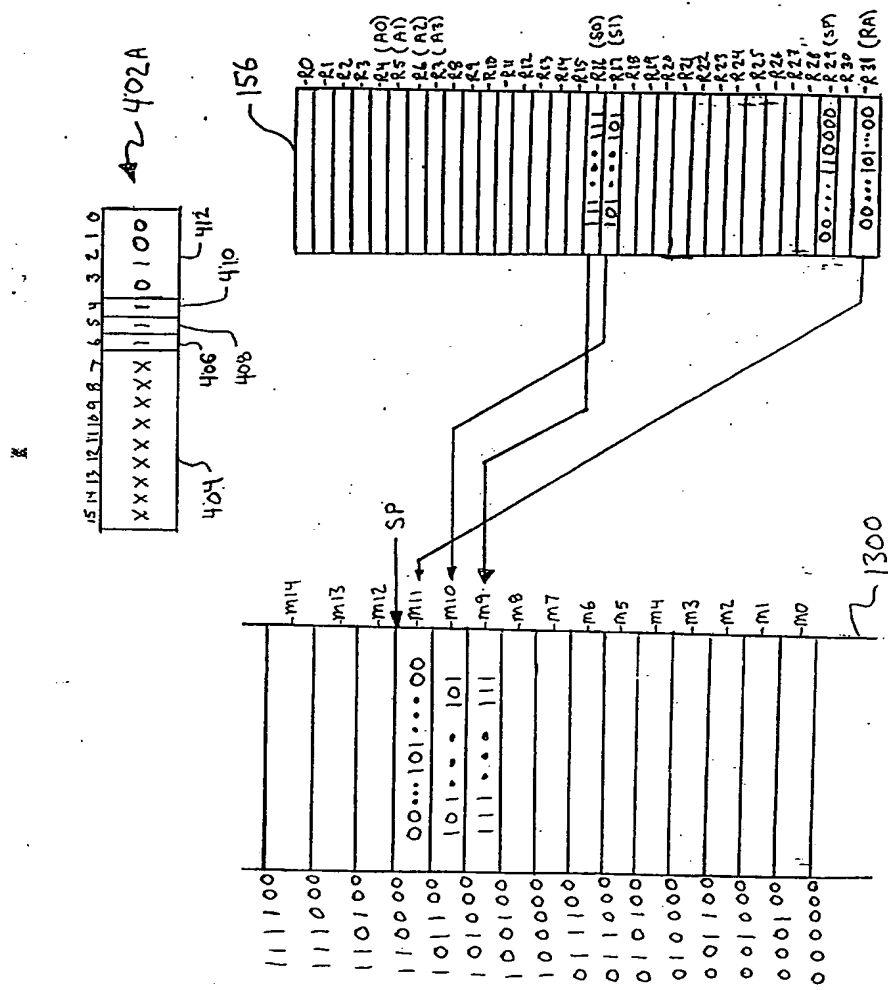


FIG. 13

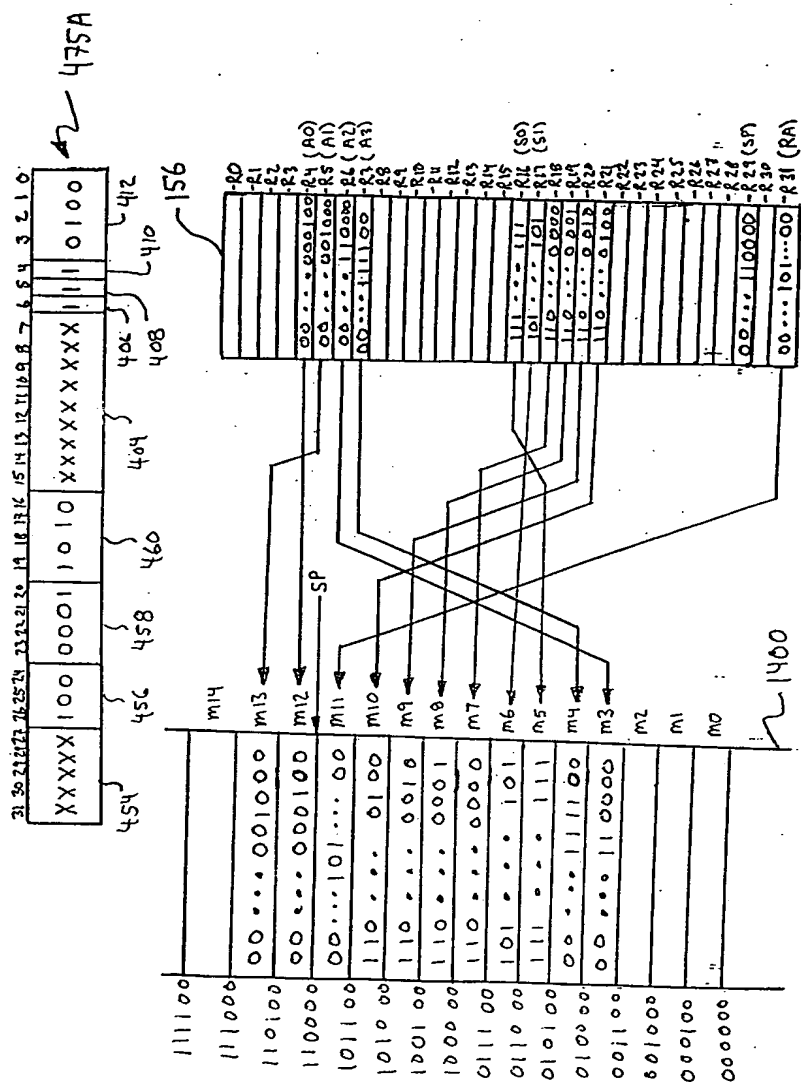


FIG. 14

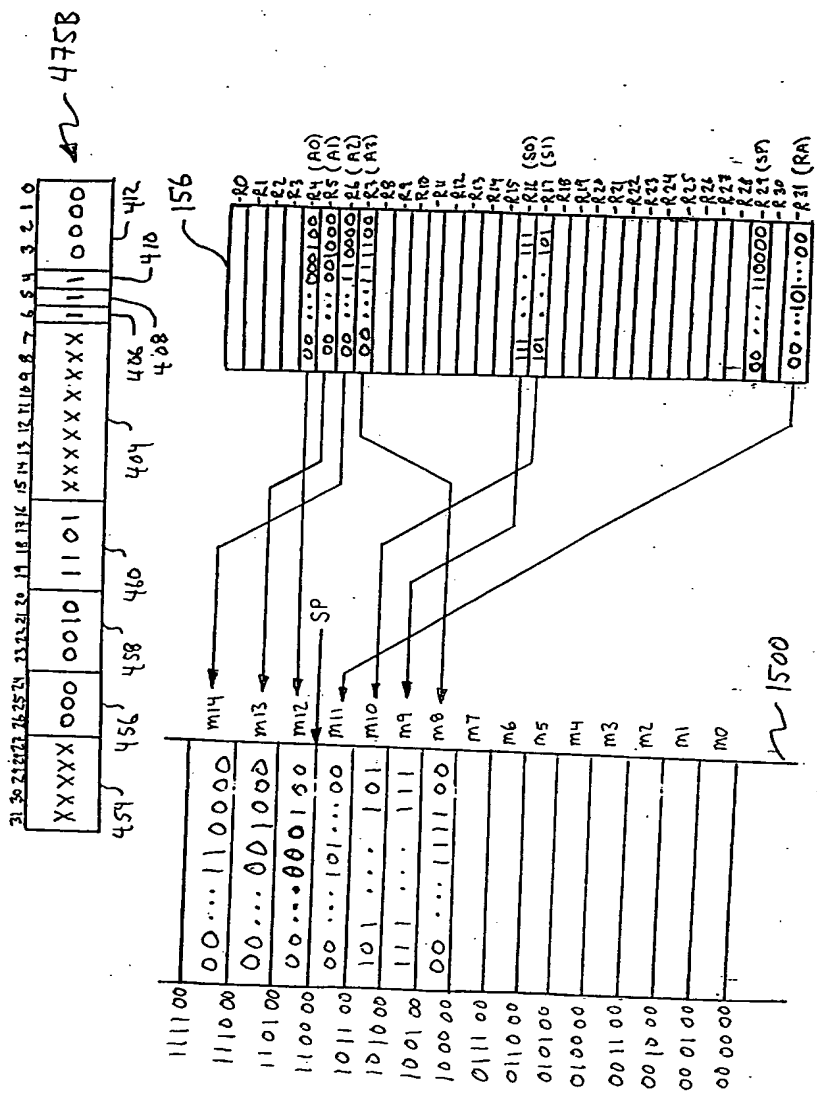


FIG. 15

五

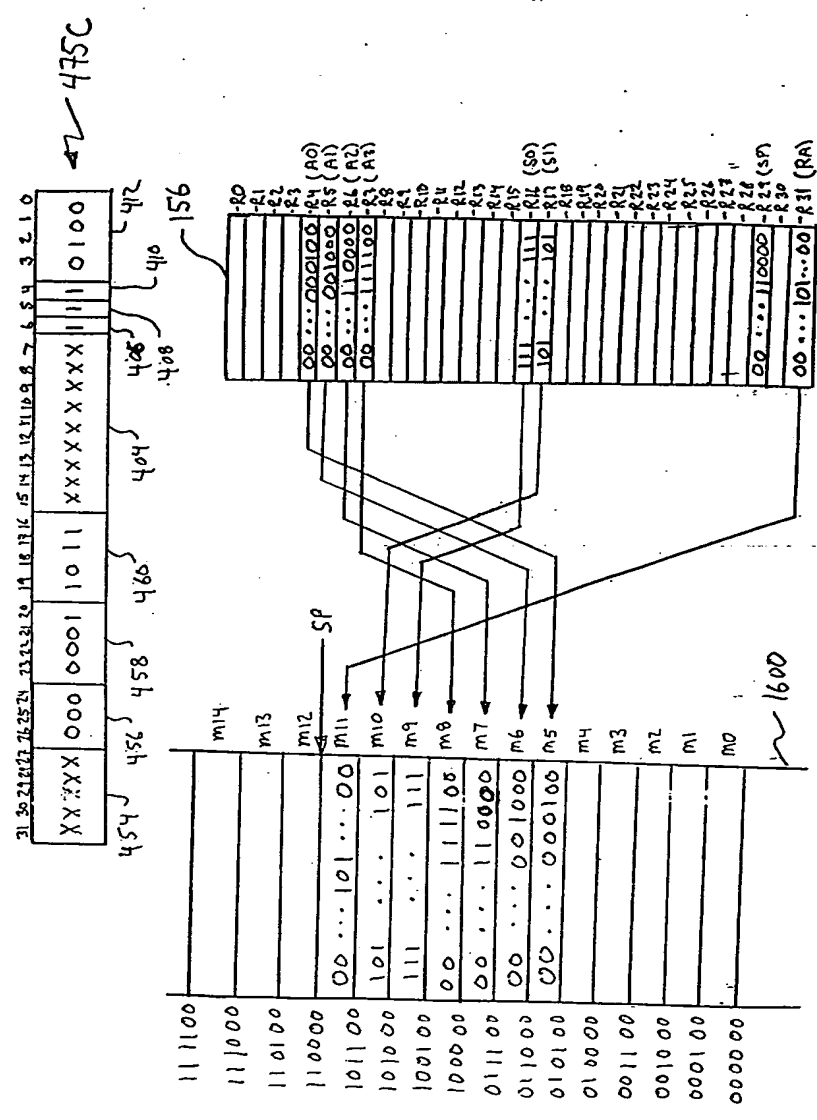


FIG. 16

Σ

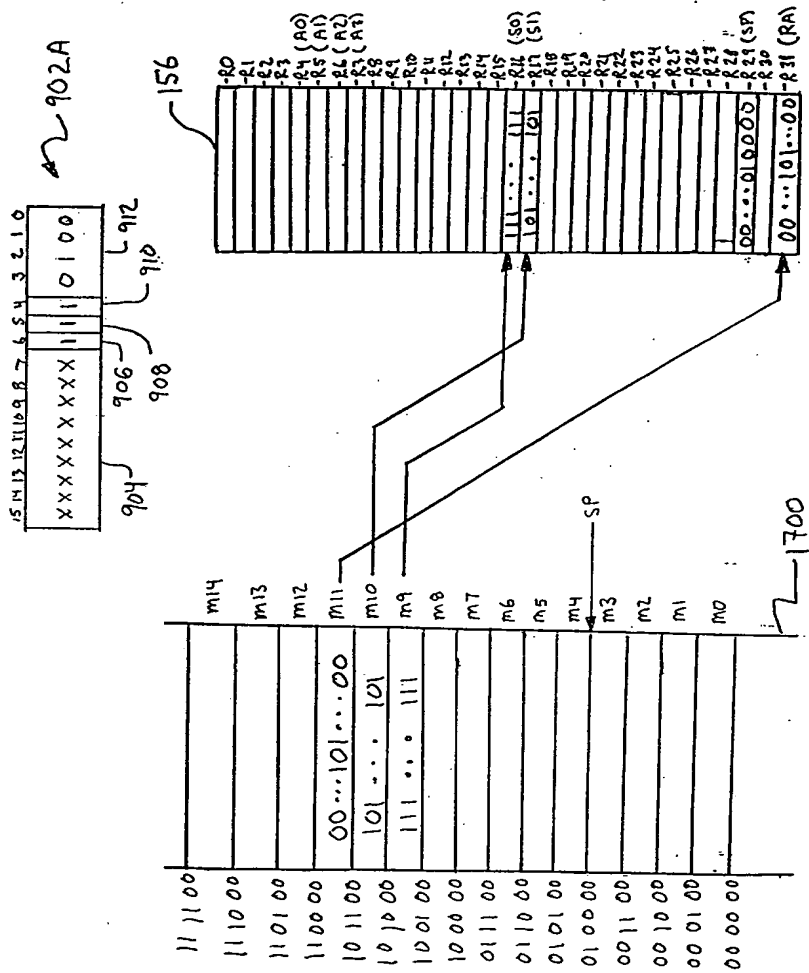


FIG. 17

XXXXXXXXXXXXXXXXXXXX

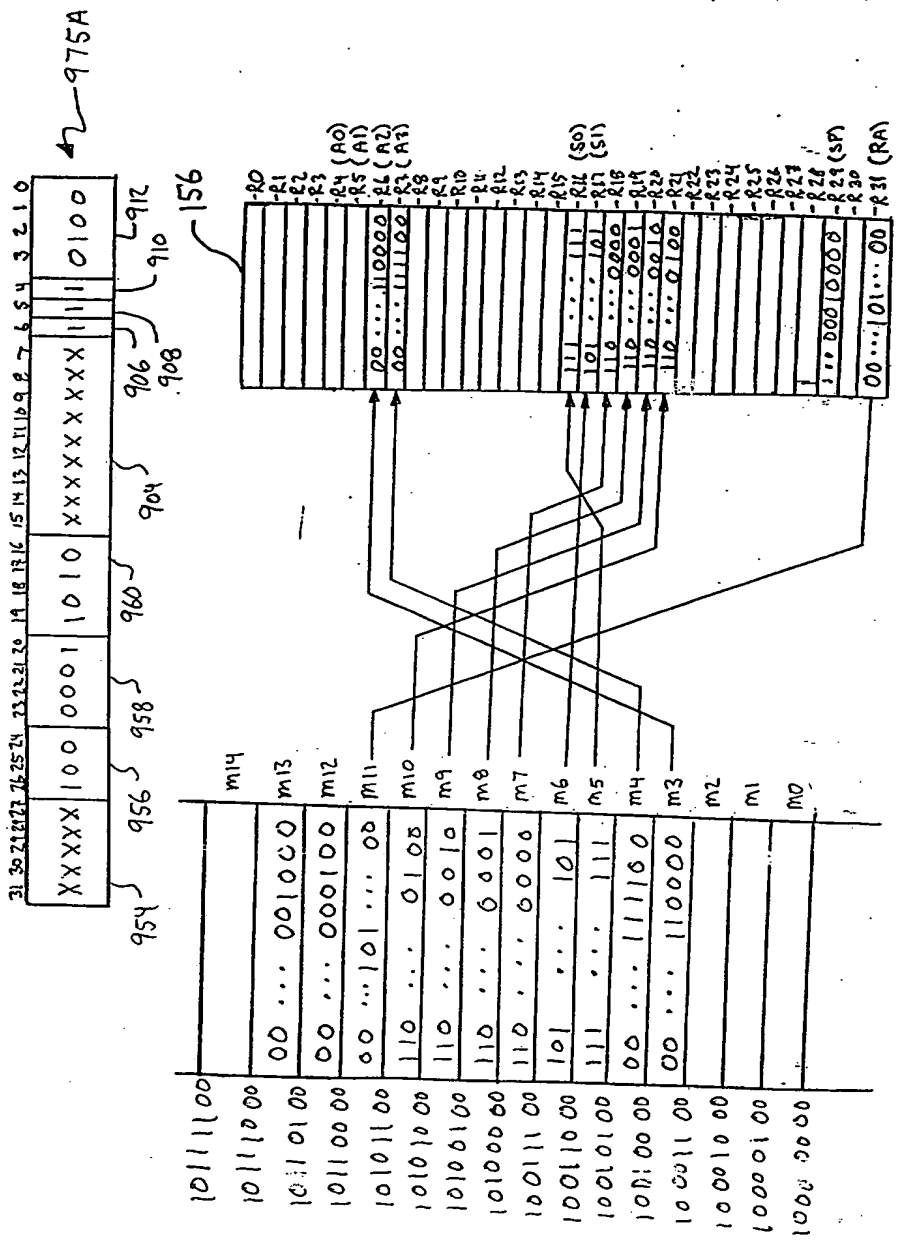


FIG. 18